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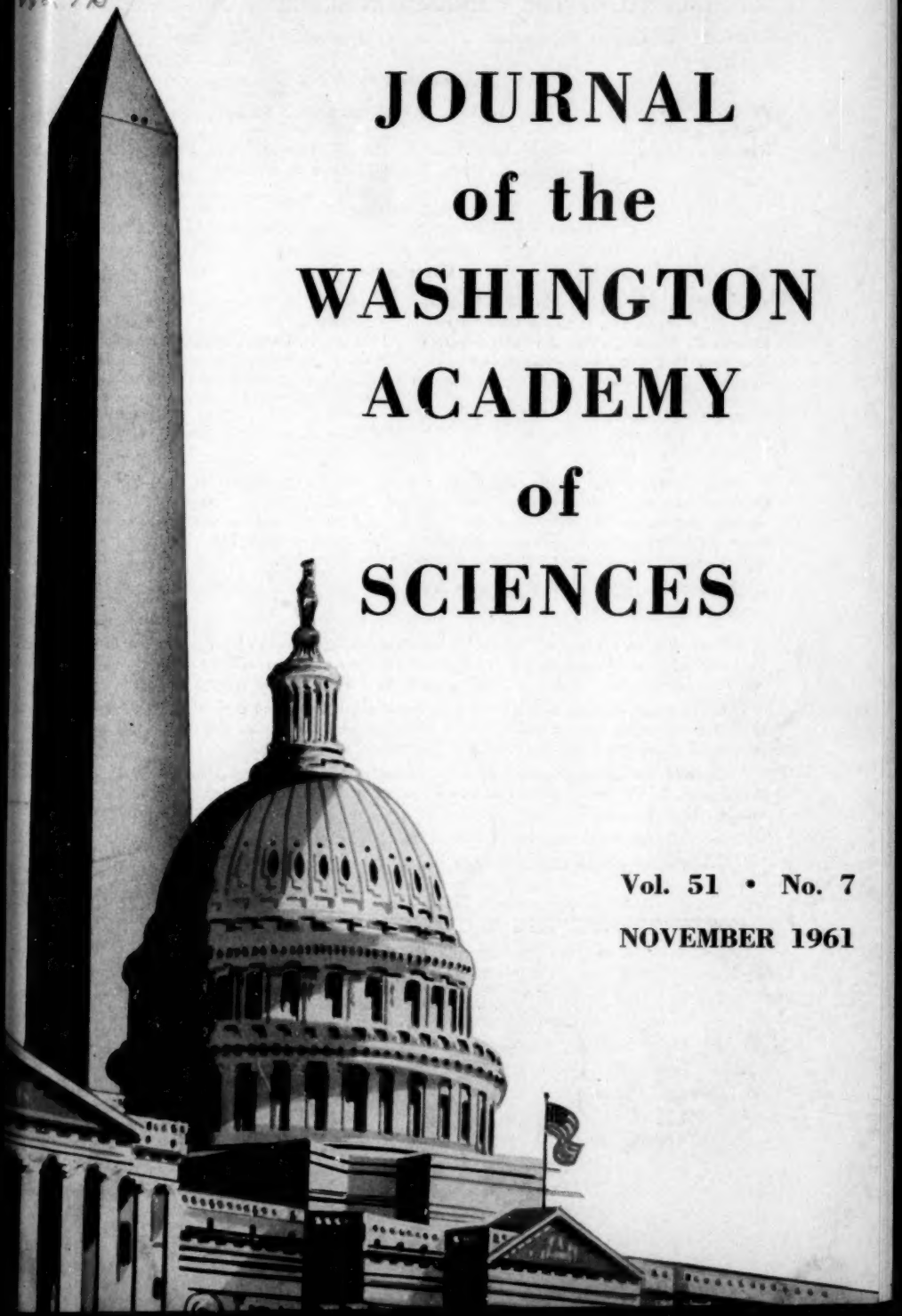
JOURNAL of the WASHINGTON ACADEMY of SCIENCES



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This Journal, the official organ of the Washington Academy of Sciences, publishes historical articles, critical reviews, and scholarly scientific articles; notices of meetings and abstract proceedings of meetings of the Academy and its affiliated societies; and regional news items, including personal news, of interest to the entire membership. The Journal appears eight times a year in January to May and October to December.

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Chemicals to Sterilize Insects

Arthur W. Lindquist

Entomology Research Division, Agricultural Research Service, USDA

Since earliest recorded times, man has sought to protect himself against insects attacking his person, his crops, and his livestock. He has tried flails, brush brooms, swatters, nets, traps, and chemicals. Always his intent was to destroy the pests quickly. During the last 30 years, emphasis has been placed on quick kill by means of insecticides. The agriculturist, householder, and layman have stressed the need for quick knockdown and kill of insect pests. But now a change in thinking has occurred among entomologists and others regarding the control of insects.

The newest idea is to interfere with the reproduction potential of insects and thus reduce their ability to develop in large and damaging numbers. That an insect is rendered sexually sterile does not mean that it will die immediately. The pest will live for a normal length of time but will be incapable of reproduction. Individual and area control will be possible, but results may be slower than with direct kill by insecticides.

Gamma Irradiation

Control of screw-worms by gamma radiation, which makes the males sterile, has had wide publicity. This method consists essentially of rearing and releasing sexually sterile males in numbers greater than exist in a natural population until control or eradication of the natural population results. If adequate numbers of sterile insects are released, their very preponderance gives them an advantage in competing with the normal males for the females existing in the natural population. Reports of laboratory and field investigations dealing with the sterile-male method have been recorded by Bushland (1951-1953), Lindquist (1955), and Knipling (1955). These reports constitute some of the most interesting entomological reading of the past two decades. Proof of the soundness of the gamma-radiation sterile-male method was provided by the eradication of the screwworm from the 170-square-mile Island of Curacao (Baumhover 1955). The remarkable feat of eliminating this pest from Florida and the Southeastern States in 1958 is an outstanding achievement. In this program 3-¼ billion reared, sterile flies were released systematically over approximately 85,000 square miles for a 17-month period. This entirely new method of insect control has resulted in an annual saving to the livestock industry estimated at about $20 million.

Chemosterilants

As an extension of the gamma-induced sterility concept, research was initiated at our Orlando, Fla., laboratory three years ago to develop chemosterilants that would induce insect sterility. Such a method presents an intriguing and exciting area for research. What if certain of these chemicals could be used instead of radiation for sterilizing large numbers of insects? Their use might turn out to be an important advance, particularly if the chemicals would cost less or be more practical than gamma radiation and produce a sterile but more vigorous insect. But most importantly, could insects within a natural population somehow be exposed to such chemicals, and sterility effects achieved, without the necessity of rearing and releasing vast numbers of treated insects? It seems clear that a population in a closed or isolated

system could be greatly reduced or even eliminated if a high enough percentage of the native insects were systematically and continuously exposed to a sterilizing chemical.

A chemical sterilizing both males and females would prevent reproduction among those actually sterilized and thus inhibit reproduction to the same extent as would an insecticide that kills directly. If, for example, 90 percent of the females contacted the sterilant, reproduction would immediately cease in those individuals. If 90 percent of the males also contacted the sterilant, these would be available to compete with nonsterile males in mating with untreated females. There should be a preponderance of these sterilized males over the remaining untreated 10 percent of the population or newly emerged specimens. These numerically superior sterile males would thus reduce the population further and provide a bonus effect over the conventional method of direct kill by insecticides. In this way, a chemosterilant should provide a potential 99 percent control of reproduction instead of the 90 percent expected from an insecticide. Knipling (1959) has calculated the theoretical population decline of insect and other animal populations subjected to a treatment which causes sterility versus one that produced direct kill. It should be pointed out, however, that the sterility effects must not significantly change sexual vigor or competitiveness of the treated males. A type of sterility which destroys sexual behavior or other habits would have no advantage over direct destruction of the organism.

Possibilities for Use of Chemosterilants

Since some of the experimental sterilizing chemicals are effective as residual treatments on surfaces, it might be possible to use them safely on farm buildings or other places where insects rest or congregate. Their application might be feasible on vegetation in or near swampy areas where horse flies, deer flies, and biting gnats breed or congregate.

A residual treatment of resting places such as sheds, buildings, and tree holes might provide control of disease-carrying mosquitoes. The females exposed to the treatment would lay infertile eggs and the males exposed would render sterile some of the females not so exposed, thus further contributing to a population decline. Complete elimination of a disease-carrying species may not be necessary since it is well known that malaria, for instance, can be controlled by the residual treatment of buildings where the anopheline vector rests. This treatment destroys only a fraction of the population, but is sufficient to break the transmission cycle of the disease. However, a sterility-producing treatment would be expected to be slower in preventing vector transmission since the sterile insects might still be capable of transmitting the disease. However, if a sterilizing agent could also be made to act directly on the disease organism in the insect, control of the disease might be produced more rapidly.

Chemosterilants might be used along with a bait or lure. The attractant would draw the insects to a central point and exposure to the chemosterilant would be by contact with the residue or by oral ingestion of treated food. Insecticides have proved highly effective, for example, when incorporated in a bait for fly control (Gahan *et al.* 1953). Substitution of a chemosterilant for an insecticide might thus offer a means of producing sterility in a high percentage of the natural population of this insect.

A potentially useful scheme might be to combine an insecticide and a chemosterilant (Lindquist 1961). A combination of both types of chemical could be used in a bait, as a residual treatment of vegetation or buildings, or as a space spray in restricted situations. This plan might at first seem contradictory. What advantage can there be in killing insects that have been made

sterile? However, it must be realized that insecticide treatments seldom kill all the insects coming in contact with the material. Some individuals of any population have a natural tolerance to insecticides. Furthermore, most insect populations have developed varying degrees of physiological resistance to insecticides and some of the insects escape death even though exposed. The advantage of a combined chemosterilant and insecticide treatment is that the insecticide would kill the weaker forms and make the resistant surviving females incapable of reproduction. Surviving males would act as a further deterrent to population increase by mating with newly emerged or other nonsterile females that have escaped treatment. The insecticide in a combined treatment would provide some immediate control, whereas the sterilant would have a more complete and lasting effect in reducing the insect population.

A combined treatment might be an effective way of preventing insect resistance to insecticides. Of course, there is the possibility that insects might develop physiological resistance to the chemosterilants. Insecticide-induced resistance is a result of selection of individuals more capable of withstanding the effects of these materials, or with an innate capacity to develop effective physiological systems to rapidly metabolize insecticides and subsequently transmit such characteristics to their progeny. It does not seem likely that chemosterilants would induce such physiological resistance, since the factor of selection of stronger individuals by killing the weaker does not seem to apply. Furthermore, chemosterilants act on the reproductive system without mortality, which would appear to eliminate the process of selection. However, resistance to any chemical cannot be ruled out. Behavioristic resistance such as avoidance of the chemosterilant could perhaps develop in a manner similar to that reported by Schmidt and LaBrecque (1959), who found that house flies avoided malathion-treated baits.

Recent Research

For several years, it has been known that certain chemicals prevent ovarian development and affect reproduction in *Drosophila* (Goldsmith *et al.* 1952) and in house flies (Mitlin *et al.* 1957). It thus seemed plausible that safe chemicals could be found to sterilize both male and female insects. About three years ago a screening program to find such chemicals was initiated at our Orlando, Fla., laboratory. The house fly was the principal test insect, although two species of mosquitoes were also tested with the materials showing some activity on the house fly.

As was expected, screening of chemicals to find those possessing sterilizing properties was time-consuming and laborious. Chemicals that kill can be detected in a day or two, but testing of chemosterilants involves treating the insect, mating treated and untreated specimens, and determining hatchability of eggs. These steps take approximately 30 days for the evaluation of only one chemical. To date, several hundred such compounds have been given a preliminary screening.

Amethopterin (LaBrecque 1960) was one of the first chemicals showing promise. A single feeding of 0.5 percent in sugar bait prevented female house flies from ovipositing but had no effect on the males.

In 1960, a few compounds were found that seemed to have exceptional promise in sterilizing both male and female house flies, mosquitoes, and stable flies. LaBrecque (1961) reported on three ethylenimine compounds known as alkylating agents, and which are commonly referred to as radiomimetic compounds. The coined common names of these materials, together with their chemical names, are as follows: Aphoxide (tris(1-aziridinyl)phosphine oxide), aphomide (*N,N'*-ethylenebis[*P,P*-bis-(1-aziridinyl)-*N*-methylphosphinic amide]). and apholate (2,2,4,4,6,6-hexa(1-aziridinyl)-2,4,6-triphospha-1,3,5-triazine).

These compounds, fed to adults at concentrations of 0.5 to 1.0 percent in the

food, caused sterility of both sexes. The flies must feed on treated food within three days after emergence in order to become sterile. Females given treated food and mated with normal males produced only a few eggs, and these did not hatch. Matings of treated males with normal females resulted in almost normal egg production, but none of the eggs hatched. In small-cage tests, treated flies competed satisfactorily with normal flies. In large-room tests, flies given untreated food produced 40,000 pupae, whereas flies given a choice of treated and untreated food produced 13 to 121 pupae. These results are highly encouraging and suggest that chemosterilants have a reasonable chance of providing practical control.

Recent research at Orlando showed that both sexes of *Aedes aegypti* (Linn.) and *Anopheles quadrimaculatus* Say were sterilized by incorporating aphoxide or apholate in the adult food or placing it in the larval water medium. Aphoxide has been especially promising as a residual treatment of resting surfaces.

In tests with apholate on the stable fly (*Stomoxys calcitrans* (Linn.)), it was found that a 48-hour exposure to a residual film applied on glass at a rate of 10 mg. per square foot caused nearly 100 percent reduction in hatch of eggs from treated females mated to treated males. Of particular interest was the fact that apholate was nearly as effective 12 weeks after treatment as at one week, thus showing long-lasting residual effect. Topical applications of aphoxide at a rate of 3.7 mg. per fly was slightly more effective on males than on females.

Effect of Chemosterilants on Vigor

Insects exposed to gamma radiation usually are not as long-lived as unexposed insects, and somatic damage tends to make treated insects less vigorous and competitive than the normal insects. Such a radiation effect is a serious obstacle to the possible use of gamma-irradiated insects for controlling certain mosquitoes, the boll weevil, the gypsy moth, and no doubt other species. Although the screw-worm does not seem to be injured to any great extent by radiation, there is reason to believe that the efficiency of treated males released in nature is reduced. Competitive and vigorous seekers of native females are required to achieve full effect of sterile insects in control or eradication. If chemosterilants can be developed which produce sterile males that are stronger, longer-lived, and more active seekers and thus more competitive than those treated with radiation, a great step forward would be taken in the utilization of the sterile-male technique, involving the rearing and release of sterile insects.

Unpublished research by G. C. LaBrecque, D. W. Meifert, and Carroll N. Smith at Orlando with house flies in cages, comparing radiation and the administration of apholate, indicates that the chemosterilant is more efficient in producing competitive males than gamma-ray treatment. Some males were given 1 percent apholate in the adult food for three days after emergence. Others were exposed to 2500r in the pupal stage and introduced into cages at a ratio of four sterile males to one normal male and one normal female (4:1:1). The hatch of all eggs laid by females was reduced 77 percent by irradiated males and 82 percent by the chemosterilized males. The theoretical reduction of viable eggs by either method with this ratio is 80 percent. The actual 82 percent reduction of hatch caused by the chemosterilized males is very little less than the 83 percent theoretical reduction by use of five sterile males to one each of normal males and females (5:1:1). It appears therefore that the chemosterilized males are much more efficient. In a rearing and release experiment, four chemosterilized males would in theory be able to effect as much control (82 percent) as five chemosterilized males (83 percent)—ratios of 4:1:1 as compared with 5:1:1.

In other laboratory-mating tests at Orlando, it was shown that apholate-treated

male house flies at ratios of 3, 5, and 10 times the normal males and females resulted in average reductions of viable eggs of 97, 100, and 100 percent respectively. These results are even more significant than those given in the preceding paragraph. The theoretical reductions of viable eggs at these ratios are 75, 83, and 91 percent respectively. Thus it appears that the chemosterilization induces much greater than normal efficacy. If these observations are borne out in practical use, they could have an enormous bearing on control efforts.

It should be emphasized, however, that these experiments measured only the viability of eggs resulting from the mating of sterile males with normal females. It is possible that behavior patterns other than mating efficiency could be affected by either treatment. Under field conditions, competitiveness and vigor may be different from that in laboratory cages.

Preliminary competition tests in cages with *Aedes aegypti* indicate that apholate-treated males are considerably more effective, that is, cause greater reductions of viable eggs and are longer-lived than irradiated males. The experiments indicated that the chemically sterilized males were more competitive with normal males in mating with normal females.

Problems and Hazards

Experimental field work to determine how to use these chemicals, and later practical use of chemosterilants by individuals or control agencies, pose several problems. One of the first needs is to determine where, when, and how to apply these materials so as to take full advantage of their properties. With nearly any insect species, much detailed information needs to be known about feeding, resting, mating, emergence, and flight habits so as to apply the chemosterilant correctly and at the right time. For example, the preferred resting places of mosquitoes in nature must be known for residual treatment of those areas. Most mosquitoes and numerous other insects rest on vegetation near the water or site from which they emerge, and dosages must be adjusted to take care of the length of time particular species rest thereon. With the chemosterilants now being explored, the greatest efficiency will result if the insects ingest or contact the chemical very soon after emergence.

The use of chemosterilants against the natural population to achieve insect control or eradication has not reached the practical state. There are many unanswered problems that need investigation and resolution. The problem of previously mated insects migrating into the treated area may nullify results in a small area. Will such normal insects invade a treated area in sufficient numbers to prevent adequate control? With some insects, community use of chemosterilants on a wide basis may be necessary. With others, migration may not be of a magnitude sufficient to reduce control. Will a delay in obtaining control of bloodsucking forms or plant feeders by the use of chemosterilants alone be accepted by the public? Can efficient ways be found of minimizing destruction of crop pests during the time required for sterile insects to reduce the population? Such objections might be overcome by using conventional killing agents to reduce the population to noneconomic levels and then relying on chemosterilants for greater efficiency in preventing population increase. Much field experimentation with any given species of insect will be required to answer the many questions on the efficacy and practicability of chemosterilants in controlling insects.

It is obvious, therefore, that detailed information on biology and habits is an important prerequisite for effective use of these chemosterilants. More than ever before, entomologists need to work toward a fuller knowledge of insect habits. An immense amount of research is also required to devise ways to test and use chemosterilants so as to obtain practical control or eradication results.

Another important factor may be the effect of chemosterilants on beneficial insects, such as efficient parasites and predators. If an effective compound is found for use against a destructive species, and it also destroys the native parasites and predators because of the way it is used, methods must be devised to apply the chemical so it will not harm or, at least do minimum damage to, the beneficial forms.

Both domestic and wild animals, fish, birds, and other animal life, including man, must be considered in studying the use of chemosterilants. One hopeful sign is that some of the candidate sterilants now being investigated seem to have an almost specific effectiveness against species or groups of species. Perhaps materials specific against certain forms or groups can be found or synthesized, and thus provide a safeguard against sterilizing effects on beneficial organisms. The opportunities for developing chemosterilants specific in action against insects, with little hazard to higher animals, should be as good as developing insecticides specific in action against insects and nontoxic to higher animals.

In summary, therefore, it appears that the application of chemosterilants for insect control has considerable promise. These compounds might be used in lieu of radiation to produce vigorous competitive males for release; and they offer great potentialities for use against the natural population, thus obviating the necessity for release of enormous numbers of sterile specimens such as was done in the highly successful eradication program of the screw-worm in the Southeastern States.

The recent discovery that certain chemicals will sterilize both males and females of house flies, mosquitoes, and stable flies by contact or ingestion provides exciting possibilities for research and control. Such materials, provided they are safe to use, offer greater possibilities than killing agents. Combining insecticides and chemosterilants in one treatment may be a way to obtain immediate and longer-lasting control than with insecticides alone. The insecticide will act quickly on the weaker individuals, and the chemosterilant will make surviving strong individuals incapable of reproduction. This method may be an effective approach to combating insecticide resistance. It does not appear likely that resistance to chemosterilants will develop as quickly as when insecticides are used alone.

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WAS Elections Procedures

Heinz Specht

Secretary, Washington Academy of Sciences

Election of the officers of the Washington Academy of Sciences is carried out annually according to time-encrusted procedures which have not been changed in any major way for many years, certainly not since 1937. It is probable, however, that most members of the Academy have only a hazy notion of how election actually occurs, and it may well be that even some of the Academy officers will find something of which they were not aware in the following commentary on this process.

In order to fully understand the implications of certain parts of the procedure, it should be pointed out that the Board of Managers of the Academy is defined in the Bylaws as follows:

Article V—Board of Managers

Section 1. The activities of the Academy shall be guided by the Board of Managers, consisting of the President, the President-elect, one Delegate from each of the affiliated societies, the Secretary, the Treasurer, six elected Managers-at-large, the Editor, the Managing Editor, the Archivist, and the Custodian of Publications. The elected officers of the Academy shall hold like offices on the Board of Managers.

Section 2. One Delegate shall be selected by each affiliated society (see Art. VIII, Sec. 3). He shall serve until replaced by his society. Each Delegate is expected to participate in the meetings of the Board of Managers and vote on behalf of his society.

Section 5. The Board shall have power to fill vacancies in its own membership until the next annual election. This does not apply to the offices of President and Treasurer (see Art. IV, Sec. 5), nor to Delegates (see Art. V, Sec. 2).

It is apparent that the Academy, which is composed of an elected membership from whom six Managers-at-large are elected, and a body of 26 affiliated societies, each of which is privileged to send a Delegate, is thus governed by a dual representation. It should be pointed out, also, that the Academy membership is a dues-paying one and also committed to the policies of the Academy through a vote, while the affiliates, as such, are privileged only in the following manner:

Article VIII—Cooperation

Section 2. . . . . provided, it (the Academy) shall not have power to incur for, or in the name of, one or more of these societies any expense or liability not previously authorized by said society or societies . . . .

The common bond between the affiliates and the Academy is, of course, the common membership; but it is apparent that those affiliates with few Academy members on their rosters have a proportionately greater representation on the Board than those with many Academy members.

To turn now to the matter of election of officers, the following is the serial list of admonitions and procedures prescribed in the Bylaws:

Article IV—Officers

Section 11. No one shall be eligible to hold elective office until one year after election to membership.

Section 12. Prior to November 1 of each year the Nominating Committee, having been notified by the Secretary, shall meet and nominate by preferential ballot, in the manner prescribed by the Board of Managers, one person for each of the offices of President-elect, of Secretary and of Treasurer, and four persons for the two Managers-at-large whose terms expire each year. It shall, at the same time and in like manner, make nominations to fill any vacancy in the foregoing. Not later than November 15, the Secretary shall forward to each Academy member a printed notice of these nominations, with a list of incumbents. Independent nominations may be made in writing by any ten active members. In order to be considered, such nominations must be received by the Secretary before December 1.

Section 13. Not later than December 15, the Secretary shall prepare and mail ballots to members. Independent nominations shall be included on the ballot, and the names of the nominees shall be arranged in alphabetical order. When more than two candidates are nominated for the same office the voting shall be by preferential ballot in the manner prescribed by the Board of Managers. The ballot shall contain also a notice to the effect that votes not received by the Secretary before the first Thursday of January, and votes of members whose dues are in arrears for one year, will not be counted. The Committee of Tellers shall count the votes and report the results at the annual meeting of the Academy.

Section 14. The newly elected officers shall take office at the close of the annual meeting, the President-elect of the previous year automatically becoming President.

The reader will now have become aware of the fact that not only is it highly desirable that Academy members, who are members of affiliate societies, take an active part in instructing the Delegate from each such society with regard to his actions on the Nominating Committee, but also that every effort should be made to nominate to Academy membership those eligible in the affiliated societies in order to get to a thoroughgoing representation and true reciprocal benefits to both the Academy and its affiliates.

New WAS—Affiliate Directory Planned

Robert W. Krauss

University of Maryland

For some time, the Academy's Board of Managers has been aware of the desirability of having a directory of scientists resident in the Washington area. In this connection, a committee was recently appointed by President Abelson to investigate the feasibility of preparing such a register, which would include all members of the Academy as well as members of its affiliated societies.

The membership of the committee is as follows:

Edmund M. Buras, Harris Research Laboratories

Charlotte C. Campbell, Walter Reed Army Institute of Research

Lowell E. Campbell, Agricultural Research Service
J. Reid Clement, Naval Research Laboratory
Ashley B. Gurney, National Museum
Robert W. Krauss (chairman), University of Maryland

The committee is fortunate to have as its consultants James I. Hambleton, Archibald T. McPherson, Waldo L. Schmitt, and Bourdon F. Scribner, all of whom have had prior experience with the preparation of directories.

In any venture such as this, success will depend on the active support of the members and officers of the affiliated societies. Accordingly, the committee has written to each affiliate, asking whether the society is willing to have its membership included in the directory, and whether the society is willing to give financial support to the directory. It is to be hoped that the result of this survey will be a vote of confidence in the project.

The value of a cross-indexed directory with current addresses, specialties, and affiliations of the splendid assemblage of scientists in the Washington area should be obvious. Not only will this directory serve the members well; but also it should serve as an introduction for many Government agencies and private corporations to the strength and skills of the scientists of the Washington area.

Board Recommends Dues Increase

An increase in dues from $6 to $10 for resident members, and from $5 to $7.50 for non-resident members of the Washington Academy of Sciences, was advocated in a report of the Policy and Planning Committee to the Board of Managers at the October 3 meeting of the latter. The Board voted unanimously to recommend the increase to the membership of the Academy, which will be asked to vote on the question in December.

The chairman of the Policy and Planning Committee, supported by the treasurer of the Academy, pointed out that expenses for 1961 will exceed income, and that the secretary and treasurer should have clerical assistance in 1962. The increase, if voted by the members, will stop deficit spending, which occurred also in 1959 and 1960, and will provide for payment of some clerical help.

Joint Board Sponsors Student Research Program

Leo Schubert

Chairman, Department of Chemistry, American University

During the summers of 1960 and 1961 the Joint Board on Science Education and cooperating groups conducted an interesting experiment in science motivation and experience for secondary school students. This involved the placement of gifted students in scientific laboratories of the Washington area, for an eight-week period of training in research methods. The students received no financial compensation except for a contribution toward their expenses for carfare and lunches.

The experiment had a modest beginning with 15 students in 1960, when it was financed wholly by local scientific societies. It was expanded to 36 students in 1961, and was financed largely from funds supplied by the National Science Foundation, with ancillary support by the local societies. It is expected that the program will be continued in the summer of 1962, on an even larger scale.

The writer served as director of the program and chairman of the Research Participation Committee of the Joint Board. Other members of the Committee were Louise Marshall (NIH), Keith Johnson (Washington Public Schools), Ira Hansen (GWU), John Leonard (NRL), Theodore Litovitz (CU), and Stephan Schot (AU). Assisting the Committee as *ex-officio* members were the following science supervisors of local school systems: Phoebe Knipling (Arlington), Charles Davis (Fairfax), and Edmund Burke (Montgomery). Other science supervisors of the area were invited to participate, but were unable to accept. All those associated with the Committee served without compensation.

The program was fortunate to secure the services of Margaret H. Maury, science teacher at Sidwell Friends School. Mrs. Maury acted as associate director of the program; she assumed the important obligation of visiting the laboratories at which the students worked, and serving as liaison between the students, their scientist-supervisors, and the director.

In addition to $2,500 provided by NSF, funds were contributed by the following: Joint Board ($790), Washington Junior Academy of Sciences ($500), Washington Academy of Sciences ($300), Chemical Society of Washington ($300), and the Montgomery County Board of Education ($200).

The program was advertised at virtually no cost. The mimeographed announcements were distributed through normal channels by the school systems themselves, without any postage involved. There were 170 qualified applicants representing 63 schools in the area. Invitations were sent to 38 students; only two students responded negatively. The distribution of the students was as follows: Montgomery (9), Prince Georges (9), Washington (8), Arlington and Alexandria (3), Catholic (3), private (2); two students were from outside the area. In all, 24 schools were represented.

The program was centered at American University. The University provided facilities for a series of orientation lectures at the beginning, and a series of meetings at the end when the students reported in seminar fashion what they had accomplished during the summer. The secretarial and administrative functions were housed at the University.

The unique feature of the experiment was that cooperation was obtained from research organizations in the area. In this way, the science education potential of the local research organizations was utilized; this area has more scientists per unit of population than any other geographical area in the country.

In the cooperating laboratories, the students were able to engage in genuine research under competent scientists. The point of view was that they were apprentices, and that they had a great deal to learn; no effort was made to treat them as geniuses who had already mastered much of science. It was deemed important to expose them to research and to productive scientists so as to assist in motivating them toward science as a way of life.

The cooperating laboratories were most generous with their assistance; they offered twice as many openings as there were students to fill them. The laboratories and the numbers of students they assumed were: American University Chemistry Department (4), U. S. Department of Agriculture, Beltsville (8), Walter Reed Army Institute of Research (6), George Washington University Surgical Research Laboratory (1), Resources Research, Inc. (1), Goddard Space Flight Center (3), Melpar, Inc. (3), National Bureau of Standards (2), National Institutes of Health (7), and

Georgetown University Observatory (1). The personnel officers and research administrators in these laboratories rendered indispensable assistance in explaining the program to the scientists in advance, in planning with the scientists for student assignments, and in facilitating visits by the associate director of the program.

The students were expected to keep regular working hours, identical with those of their supervisors. They were given $10 weekly for eight weeks to assist in paying for carfare and lunches, so that this experience would not prove to be a financial burden. They were expected to behave as junior research assistants, and it was obligatory upon them to keep a research record book; this served later to provide material for the concluding seminars. The range of research subjects varied widely and reflected many of the research interests of the cooperating laboratories. As the students' skills and understandings increased, the scientists enlarged their responsibilities; toward the end of the program, many of the students were able to work out ideas of their own.

A serious preliminary effort has been made to evaluate the success of the program; an ultimate evaluation, of course, will require years and can be established only in terms of what happens to the students. The personnel officers of the cooperating laboratories were most helpful in this evaluation. The students as well as the scientists were requested to evaluate the program in as objective a manner as possible. Without exception, all the students believed the program to be excellent. They not only learned new skills, but also were much impressed with the discipline of science and the way in which knowledge leads to more knowledge. Of the supervisors, only three felt that their charges were anything less than excellent; and even these three scientists commended the program. A common statement was that "the boy is a real find" or that "the program was stimulating." The only negative criticism was that the program was not sufficiently large.

The papers relating to this program, including all the evaluation material, are on file in the writer's office, and are available for inspection. A very limited number of copies of a report on the program also are available. It might be noted that the writer has suggested sponsorship of this program to a national organization, so that comparable programs may be set up elsewhere.

WAS Holds Inter-academy Education Conference

John K. Taylor

Chairman, Committee on Science Education

A regional inter-academy conference on science education, sponsored by the Washington Academy of Sciences, was held on September 30 at the Executive House. The conference was part of a program conducted under a grant from the National Science Foundation.

The conference had the objective of informing neighboring academies of each others' programs, and to explore avenues of cooperation. It was attended by 41 persons, including two from the Maryland Academy of Sciences, three from the Pennsylvania Academy of Science, six from the Virginia Academy of Science, four from the West Virginia Academy of Science, and one from the Ohio Academy of Science. The grant provided travel expenses for out-of-

town visitors, as well as the cost of a luncheon and incidental expenses.

The morning session was devoted to reports from the academies describing their science education programs. The afternoon discussion centered on ways to improve individual programs.

In reporting the activities of the Maryland Academy of Sciences, Nigel O'C. Wolff, executive director, pointed out that it was not a professional organization, but rather that membership was open to all persons interested in science. The Academy operates a museum and a planetarium, and conducts an annual course in basic astronomy. It annually sponsors a series of popular science lectures that provide a source of income to carry on the Academy's programs.

A unique feature of its program is the preparation and circulation of self-contained exhibits on all phases of science to state high schools. Last year 763 deliveries were made to various schools. The Academy also sponsors the National Science Talent Search in the State, and recognizes state-winners in this program.

Eight full-time employees are involved in these activities, for which there is an annual budget of $70,000, exclusive of an NSF grant.

John G. Barker of Radford College and William W. Scott of VPI reported on Virginia Academy activities, largely concerned with a Junior Academy comprising 100 local chapters, with a total membership of about 3,000.

A series of regional science days are held annually at five locations—the University of Virginia, William and Mary, VPI, the University of Richmond, and Virginia State College. Student papers are presented at each, and the best are selected for presentation at the annual meeting of the State academy. A Junior Academy *Bulletin* is also sponsored and published three times a year.

The Academy is also interested in teacher preparation, and has appointed a Committee on Science Teaching to study how the Academy may cooperate with others interested in raising the standards for teaching certificates in Virginia.

K. B. Hoover, secretary of the Pennsylvania Academy of Science, reported on their activities. He was assisted by Oren S. Kaltreiter, teacher at Middletown High School, and by Albert Eiss of the Pennsylvania Department of Education. Their activities are closely associated with the junior academy program and with the Talent Search. The junior academy holds an annual meeting at which the best papers receive small monetary awards and also are published in the proceedings of the senior academy. The Pennsylvania Academy is also cooperating with the State Department of Education on matters concerned with teaching standards.

A three-part program was described by John C. Wright of the West Virginia Academy of Science. One program is a series of Saturday morning seminars for high-school students. Their visiting scientists program, now in its second year, has enlisted 25 college teachers who will visit some 100 high schools this year. An interesting activity is concerned with a faculty exchange among 17 colleges. Each college sends one faculty member to teach for one week at another institution. Room and board for the visiting instructor are furnished by the college. A National Science Foundation grant provides travel and administrative expenses and a small honorarium.

The Ohio Academy of Science operates an extensive visiting scientist program which was described by W. A. Manuel, its director. Currently, 160 scientists have been enlisted to visit a high school for a one-day period. The scientist speaks to classes and assemblies, and confers with the high school faculty. Requests for such visits have been received from 235 schools throughout the State. An NSF grant makes this program possible.

The Washington Academy program was described in detail by John K. Taylor, director of projects for the Joint Board on

Science Education. This program, consisting of a visiting scientist and engineer project, conferences on science education, sponsoring of experimental courses at elementary and secondary school level, sponsoring science fairs, a teacher awards program, and publication of *The Reporter*, is well known to most Washington Academy members.

Abner Brenner commented briefly on the local junior academy program, and B. D. VanEvera, president-elect of the Academy, described the program which provides research grants-in-aid to high school students and teachers.

The afternoon session was devoted largely to discussion of problems concerned with the administration of the various programs. Insufficient funds was a major handicap to the success of most activities. Lack of permanent staff and turnover in volunteer help is a weakening factor. This could, of course, be obviated by regular and sufficient income devoted to educational activities. The NSF grants to academies have been a real stimulus to improving local educational programs.

In closing, the conference voted unanimously that the Washington Academy request funds from the NSF to sponsor a similar inter-academy conference during 1962.

THE BROWNSTONE TOWER

Anyone who has held any office in a scientific society, either by election or by appointment, is inclined to feel that members do not support it by their dues as well as he thinks they should. This is understandable because the conscientious office holder, who wants nothing for himself, does want to be identified with a progressive, effective organization. Feeling as he does that he has given his allegiance to an important, or potentially important society, he finds it hard to understand why many of its members seem so indifferent to it, and so reluctant to increase dues upon which the service of the society to its members and to others depends.

So far as the Washington Academy of Sciences is concerned, I think I do understand the zeal of the office holder and the indifference of the uncommitted members, and can make allowances for both. Consequently, in the following reflections on dues to the Academy, I shall not write as if my readers were obstinate delinquents, but to those who for good reasons of their own do not give the Academy a high priority among their many interests. Dispassionately, I should like to argue for the improvement of its priority to be manifested later, I hope, by the approval of the members who will vote on the dues increase recently recommended by the Board of Managers. (See story elsewhere in this issue.)

The fact that the Academy has not had an increase in dues during the period in which the cost of living has doubled, is not by itself a strong argument for such increase. It is a powerful reason only if the members want the Academy to play an important role in this metropolitan area. Do they really want it, or are they interested only in the prestige of membership? And what prestige attaches to an organization too poor to do anything of which its members may be proud?

The members can, I think, be proud of the Academy as it is now, but without additional financial support I can foresee only a decline in its effectiveness; certainly no improvement will be possible. At present a few members are giving an excessive amount of time to the Academy, and are encroaching upon the time of their employers. It will become increasingly difficult to find members who will jeopardize their family life and official

employment for the Academy. The secretary, treasurer, editor, and perhaps other officers need competent help for which we should be able to pay—not full-time help necessarily, but enough to relieve them of routine bookkeeping and correspondence. The Academy also needs an executive officer—someone who can supervise the Academy's office work and see that the policies of the Academy are carried out. The executive officer should be a member of the Academy in retirement, who could derive much satisfaction from such service and who should receive an honorarium, although he might wish to serve without compensation. It is important to find someone who is able, willing, and free to think about the Academy every day, not only as an office manager but as one who can see opportunities for the Academy to be of service, and can suggest ways and means to the officers. Our sister Academy of Maryland (practically of Baltimore) has had such services from Thomson King for several years. Surely we in Washington can find an equally able and devoted executive officer.

To please, we hope, the majority of the members, the *Journal* of the Academy has ceased to be an outlet for the publication of primary research, mostly descriptive. It has taken the more difficult road requiring the organized cooperation of contributors and solicitation of manuscripts, and is becoming a journal of scientific news, opinion, and exposition, all intended to reflect the scientific activities of this area. It has a long, long way to go before its coverage can be regarded as adequate, and it is susceptible to improvement in quantity, quality, and variety. Because the *Journal* is intended to be of local interest, it is probable that non-member subscriptions (from libraries) and non-resident membership will decline almost to zero before the *Journal* becomes important enough in its new role to attract national and international attention. That means temporary loss of revenue. Increase in dues will overcome this loss and, we hope, provide a margin for improvement of the *Journal*.

If your altruism and pride tell you that the Academy is worth supporting, there are at least two actions you can take without being appointed to a committee by President Abelson: you can vote for the recommended increase in dues when you receive the ballot by mail in December, and you can propose at least one person for membership in the Academy.

—*Frank L. Campbell*

Achievement Award Nominations Requested

The WAS Committee on Awards for Scientific Achievement has announced that nominations for the Academy's annual scientific achievement awards are currently being solicited.

Each year the Academy gives awards for outstanding achievement in five areas—biological sciences, engineering sciences, physical sciences, mathematics, and teaching of science. Award winners are honored at the Academy's annual dinner meeting in January.

All members of the Academy are invited to submit nominations, which must be received by the Committee on or before November 13 in order to receive consideration. Nominations must be prepared in accordance with established procedures, which can be learned from the general chairman of the Committee or from any of the panel chairmen, as listed below:

General chairman: Norman Bekkedahl, NBS (EM 2-4040, Ext. 7070)

Biological sciences: Harold A. Rehder, National Museum (NA 8-1810)

Engineering sciences: Freeman K. Hill, APL (JU 9-7100)

Physical sciences: Malcolm C. Henderson, CU (LA 9-6000)

Mathematics: Harry Polachek, D. T. Model Basin (EM 5-2600, Ext. 377)

Teaching of science: John K. Taylor, NBS (EM 2-4040, Ext. 7855)

Science in Washington

SCIENTISTS IN THE NEWS

This column presents brief items concerning the activities of members of the Academy. Such items may include notices of talks given, important conferences or visits, promotions, awards, election to membership or office in scientific and technical societies, appointment to technical committees, civic activities, and marriages, births, and other family news. Formal contributors are assigned for the systematic collection of news at institutions employing considerable numbers of Academy members (see list on masthead). However, for the bulk of the membership, we must rely on individuals to send us news concerning themselves and their friends. Contributions may be addressed to Harold T. Cook, Associate Editor, U. S. Department of Agriculture, Agricultural Marketing Service, Room 2628 South Building, Washington 25, D. C.

APPLIED PHYSICS LABORATORY

Ralph E. Gibson, APL director, addressed the Second Research Reserve Seminar on Research Planning and Management on September 2 at Princeton University. His talk was entitled, "A Systems Approach to Research Management."

Albert M. Stone was a member of an advisory panel which evaluated the Summer Institute for High School Teachers on September 8 and 9.

Membership Forms Available

The Membership Committee is appealing to all WAS members to recommend eligible colleagues for membership in the Academy.

Criteria for membership are discussed in the October *Journal*, page 93.

Nomination forms may be obtained from the Committee chairman, Mary Louise Robbins, in the Department of Microbiology, GWU Medical School, 1339 H St., NW, Washington 5 (FE 3-9000, Ext. 510 or 554).

CATHOLIC UNIVERSITY OF AMERICA

W. Gardiner Lynn, professor of biology and head of Department, participated in the Third International Symposium on Comparative Endocrinology at Oiso, Japan, June 5 to 11. While in Japan he visited the Universities of Tokyo and the Marine Biological Laboratory of the University of Tokyo, at Misaki. En route, he visited the University of Hawaii. He received a travel grant from the National Institutes of Health.

Dr. Lynn attended the American Institute of Biological Sciences meetings at Purdue University in August. During the meetings he represented the American Society of Zoologists at a meeting of the governing board of AIBS, and attended a meeting of the Executive Committee of the American Society of Zoologists.

William R. Osgood, professor of civil engineering, attended a six-week Summer Institute on the Properties of Engineering at Iowa State University. The Institute is designed to provide experience for improving instruction in engineering materials science. It was administered by Iowa State University for the National Science Foundation and the American Society for Engineering Education.

Frank A. Biberstein, professor of civil engineering, atended the 64th Annual Meeting of the American Society for Testing Materials, held in Atlantic City, June 28-29, as a member of its Committee on Manufactured Masonry Units and as chairman of the Editorial Subcommittee. He is also a member of the Council of the recently organized Division of Materials Sciences of ASTM.

COAST AND GEODETIC SURVEY

Elliott B. Roberts, assistant director for research and development, was appointed chairman of the Committee on Geomagnetism and Aeronomy at the PAIGH meeting in Buenos Aires, Argentina, August 1-15.

Lansing G. Simmons, chief mathematician in the Geodesy Division, has been appointed chairman of the AGU Committee for the Study of the Metric System in the U.S., and also chairman of the Board of Civil Service Examiners for the Coast and Geodetic Survey.

Dean S. Carder submitted a paper, "Sub-Pacific Structure as Inferred from Seismic Waves Generated by Nuclear Explosions in the Central Pacific," which was presented at the Tenth Pacific Science Congress in Honolulu.

HARRIS RESEARCH LABORATORIES

Alfred E. Brown presented a paper entitled "Research Planning Around People" at the Military Research and Development Conference at Fort Belvoir on Septmeber 26. Dr. Brown has been appointed chairman of the R & D Research Management Round Table for the 1961-62 term.

Arnold M. Sooke has been appointed Section Editor for Textiles for *Chemical Abstracts*. This post was held for many years by Milton Harris of this laboratory. Mr. Sookne was chairman of a session on "Chemical Finishing of Cotton" at the Fall Meeting of the Fiber Society, held at West Point, N.Y., on October 11-13.

NAS-NRC

Norwood B. Gove of the Nuclear Data Project attended the nuclear physics section of the International School of Physics, held by the Italian Society of Physics during August at Varenna, on Lake Como.

Katharine Way attended the Rutherford Jubilee International Conference in Manchester, England, the first week in September.

Agda Artna and **Margaret Waggoner** are new staff members on the Nuclear Data Project. The latter will spend half time on the staff of the University of Maryland, as associate professor, during the school year.

NATIONAL INSTITUTES OF HEALTH

Chester W. Emmons, senior mycologist, left on October 2 for Japan and Indonesia, to deliver a series of lectures and participate in collaborative research. Dr. Emmons will lecture on erytococsis to the Japanese Society for Medical Mycology at Sendai, and then lecture in Osaka and other cities. In Indonesia, he collaborated in research on phymycoses and other systemic mycoses at the laboratory of Dr. Lie-Kin-Joe in Djakarta.

NATIONAL BUREAU OF STANDARDS

Dean B. Judd received the Gold Medal of the Illuminating Engineering Society on September 25, for distinguished contributions "that have conspicuously furthered the art, knowledge, and profession of illuminating engineering." The medal was awarded during the opening session of the IES National Technical Conference in St. Louis. Selection of Dr. Judd, outstanding authority on color, as IES medalist for 1961, is symbolic of the importance of color in illuminating engineering. As United States representative on the colorimetry committee of the International Commission on Illumination (CIE) since 1931, Dr. Judd has won international esteem. He has been chairman of CIE's committee of experts E-1.3.1 (Colorimetry) since its establishment in 1955.

AFFILIATED SOCIETIES

Acoustical Society of America, Washington Chapter

The new season opened on October 16 with a talk by Aubrey W. Pryce, ONR, on "Current Status of Underwater Acoustics."

American Institute of Electrical Engineers, Washington Section

At the October 10 general meeting, C. W. Schilling, director of the AIBS Biological Sciences Communication Project, spoke on "Radiation Hazards—Everybody's Business."

American Society of Civil Engineers, National Capital Section

Neal Fitz Simons, research engineer with OCDM, spoke at the October 10 dinner meeting on "Design for Protection from Effects of Nuclear Weapons," dealing with recent developments on the engineering and economic aspects of shelter design.

A former Section member, Archie N. Carter, now of Minneapolis, addressed the October 24 luncheon on the effect of major projects such as the St. Lawrence seaway, the AEC program, and the Interstate Highway system on engineering and construction at the state and local levels.

The most recent Section bulletin devotes considerable attention to a "Policies Plan for the Year 2000," just published by the National Capital Planning Commission and the Regional Planning Council. At that time, the population is expected to reach 5 million, and there is much that needs to be done if we are not to have an impossibly inefficient and unattractive urban sprawl.

American Society of Mechanical Engineers, Washington Section

A symposium on "Fuel Cell Potential for Oil and Gas Power," sponsored by the Oil and Gas Power Division of the Section, was held October 12.

Botanical Society of Washington

At the 475th meeting, October 3, Russell B. Stevens, George Washington University, addressed his remarks to the question, "Is Plant Pathology a Fake?"

Chemical Society of Washington

At the October 12 meeting at Catholic University, three concurrent before-dinner sessions featured the following talks: "Some Aspects of the Organic Chemistry of the Transition Metals," by F. G. A. Stone of Harvard University; "Equilibrium Polymerization and Copolymerization," by A. V. Tobolsky of Princeton University; and "Non-covalent Bonds in Protein Structure," by Irving M. Klotz of Northwestern University. Following a dinner attended by over 250 persons, Glenn T. Seaborg, chairman of the Atomic Energy Commission, spoke on "The Newest Synthetic Elements."

Geological Society of Washington

Three speakers constituted the program on October 11, as follows: M. Gordon Wolman, Johns Hopkins, "Downstream Effects of Dams on Alluvial Channels"; Charles Milton, USGS, "Progress in Green River Mineralogy"; and Howard T. Evans, USGS, "Studies on Hydrolysis Reactions in Solution at the Royal Institute of Technology at Stockholm, Sweden."

Insecticide Society of Washington

A program on current large-scale insect control activities was presented on October 18. Four talks were presented by USDA scientists: "Current Forest Pest Control Work," by W. V. Benedict, Forest Service; "Eradication of an Exotic Tick," by W. G. Bruce, Animal Disease Eradication Division; "Research Designed toward the Ultimate Eradication of the Boll Weevil," by C. F. Rainwater, Cotton Insects Research Branch; and "Federal Control Programs Involving Gipsy Moth, Pink Bollworm, Fire Ant, and Golden Nematode," by D. R. Shepherd, Plant Pest Control Division.

Institute of Radio Engineers, Washington Section

The general meeting of the Section on October 16 heard Thomas W. Folger, a senior security analyst specializing in investments in the electronics industry, speak on "Electronics and Investments."

Some awareness of the scope and diversity of the technical meetings within the section is available from a calendar of meetings for October in the new "Washington Bulletin." The list, omitting speakers, reads as follows: "FM and PM Interference Cancellation Techniques," "Relative Microwave Absorption Cross Section of Mankind," "Problems in Making Spectrum Signature Measurements," "Fabric Antennas and their Application," "Status of Controlled Thermonuclear Fusion Research," "Techniques of Bandwidth Compression for Telemetry," and two conferences—one an annual broadcasting symposium, and the other on reliability requirements for semiconductor device specifications.

Medical Society of the District of Columbia

The October bulletin of the Society, as usual, schedules almost daily events of interest and importance to medical specialists in the area. One cannot but be impressed with the value of this listing to those concerned with human health problems.

Society for Experimental Biology and Medicine, District of Columbia Section

Three papers, on diverse topics, appeared on the October 5 program: "Lettuce Seeds, Aphids, Cockle-burs, Petunias, and Rabbits—Photoperiodism and Growth," by A. A. Piringer, USDA; "Preparation and Properties of n-Hydroxethyl Derivatives of Adenosine, Adenosine Triphosphate, and Nicotinamide-adenine Dinucleotides (DPN)," by H. G. Windmueller and Nathan O. Kaplan, NIH; and "Chemistry of Inflammation," by John C. Houck, Children's Hospital.

CALENDAR OF EVENTS

Events which will take place, so far as we can determine at the time of writing, are noted below. Where no indication of the program other than date appears, it will in most instances be a regularly scheduled meeting of the society. Last-minute changes in time and place, or emergency cancellations, cannot be reflected here.

November 7—Botanical Society of Washington

Hugh D. Sisler, University of Maryland, will speak on some effects of fungicides on cell metabolism.

Powell Auditorium, 8:00 p.m.

November 8—Geological Society of Washington

Powell Auditorium, 8:00 p.m.

November 9—Chemical Society of Washington

Panel discussion on "The Chemical Origin of Life," by Philip H. Abelson, director of the Geophysical Laboratory, and Sidney W. Fox, Florida State University. Annual election of officers.

Walter Reed Institute of Research, 8:15 p.m.

November 9—American Society of Mechanical Engineers, Washington Section

PEPCO Auditorium, 10th and E Sts., N.W., 8:00 p.m.

November 10—Philosophical Society of Washington

Powell Auditorium, 8:15 p.m.

November 13—American Society for Metals, Washington Chapter

Students' night; discussion of "Development of High Strength Nickel Steel" by C. C. Clark, International Nickel Co.

AAUW Bldg., 2401 Virginia Ave., N.W. Dinner 6:30; technical sessions, 8:00 p.m.

November 13—Institute of Radio Engineers

Natural History Museum, 8:00 p.m.

November 13—International Association for Dental Research, Washington Section

"Thermal Expansion of Dental Materials—Clinical Significance, Apparatus, and Results Obtained with an Automatic Interferometer," by George Dickson, NBS; and "Dentistry Around the World," by Albert Russell, NIH.

Materials Testing Laboratory, NBS, 8:00 p.m.

November 14—American Institute of Electrical Engineers, Washington Section

PEPCO Auditorium, 10th and E Sts. N.W., 8:00 p.m.

November 14—American Society of Civil Engineers, National Capital Section

Rep. Robert F. Ellsworth (Kansas), will

speak on "An Engineer's Role in Politics."

Powell Auditorium. Dinner 6:00; program 8:00 p.m.

November 15—Insecticide Society of Washington

Symons Hall, University of Maryland, 8:00 p.m.

November 15—Washington Society of Engineers

Powell Auditorium, 8:00 p.m.

November 16—Society of American Foresters, Washington Section

YWCA, 17th and K Sts., N.W. Dinner meeting at 6:30 p.m.

November 20—Acoustical Society of America, Washington, D.C. Chapter

National Bureau of Standards, 8:00 p.m.

November 20—Society of American Military Engineers, Washington Post

YWCA, 17th and K Sts., N.W. Luncheon at 12:00 noon.

November 28—American Society of Civil Engineers, National Capital Section

Maj. Gen. James B. Campert will speak on "Civil Engineering in Missile and Space Programs."

Luncheon meeting, YWCA, 17th and K Sts., N.W., 12:00 noon.

November 28—Society of American Bacteriologists, Washington Branch

C. W. Emmons, NIH, speaking on "Environmental Sources of Mycotic Infections."

Walter Reed Medical Center, 8:00 pm.

November 29—Geological Society of Washington

Powell Auditorium, 8:00 p.m.

JOINT BOARD

Howard A. Meyerhoff, executive director of the Scientific Manpower Commission, is the newly-installed chairman of the Joint Board on Science Education. Serving with him are Robert B. Hobbs of the National Bureau of Standards, vice-chairman; Ralph I. Cole of Melpar, Inc., secretary; and Joseph E. Guidry of the Bureau of Reclamation, treasurer.

The annual directory of the Joint Board is now off the press, and is available for distribution to science departments of local secondary schools as well as to persons interested in science education activities. It contains names and addresses of school contact persons, personnel of various Joint Board committees, and related information. An appendix contains information on a number of supporting activities.

Copies of this 32-page booklet are regularly distributed to the heads of the science and mathematics departments of area schools by the school contact persons. A limited number are available to others on request to the Joint Board office, as long as the supply lasts.

A summary report describing the activities sponsored by the Joint Board under a grant from the National Science Foundation, is now available for distribution. It contains a summary of the Visiting Scientists and Engineers program, accounts of the proceedings of the various conferences held throughout the year, and reports from the several schools cooperating in the experimental mathematics-science coordination project.

Copies of this booklet will be sent free on request to the Joint Board office at 1530 P St., N.W.

John K. Taylor, past chairman of the Joint Board and editor of *The Reporter*, attended the Shell Conference for Science Supervisors held at Cornell University last August, to speak on "Washington Scientists Assist Local Teachers." From the trend of the discussion following the talk, it was evident that many were perhaps a little envious of the fine cooperation existing here between teachers and scientists.

The conference was attended by supervisors from throughout the country. Others present from the Washington area were Phoebe Knipling and Mrs. Tempe Franklin of Arlington, and Charles Davis of Fairfax.

JUNIOR ACADEMY

Specially-conducted trips to New York are being sponsored again this fall by the Washington Junior Academy of Sciences. The schedule called for trips to be taken on October 21 and 28, November 4 and 18, and December 9. Departures from Washington are customarily at 8:05 a.m., with return at 10:15 p.m. of the same day.

The all-expense tours cost $16.50 per person. This price includes round trip transportation in reserved coaches; milk for lunch (students carry lunch); special subway train to the American Museum of Natural History and the Hayden Planetarium, as well as entrance fees to these buildings; motor coach sightseeing tour of New York City; and a complete hot dinner in a New York restaurant. One teacher or chaperone is provided for each 20 students.

The tours are restricted to members of the Junior Academy, members of science clubs, and their friends. Participants are limited to the capacity of the trains.

SCIENCE AND DEVELOPMENT

A special seminar on transportation engineering, sponsored by the International Cooperation Administration, was held August 17 and 18. Eight professors from the University of Belgrade attended the seminar, which was organized by ICA to assist them in planning the establishment of a school of transportation

in Yugoslavia. The visitors returned to the University for three weeks in September, and will return again for two weeks in November.

The phenacridiniums, a new family of quaternary ammonium compounds, were very effective against downy mildew of lima beans in laboratory and greenhouse test conducted at Beltsville by B. C. Smale and WAS member J. W. Mitchell. The compounds were synthesized and studied for clinical use against bacteria and fungi affecting man, but have not been adopted for medical use because of the indelible yellow stain they cause. However, the stain caused at the concentrations used for plant disease control is not objectionable. Further research will be needed before these compounds are recommended.

Maryland mineral deposits are shown on a map recently released by the Geological Survey. Locations of more than 500 mines, quarries, and pits in which minerals of commercial value have been found are shown. The map (Mineral Investigations Map MR 12) was compiled from published sources, field observations, and information in the files of the Geological Survey.

A new world-wide network of earthquake recording stations will improve detection of earthquakes and monitoring of earth vibrations. The network will span six continents and will be instrumented by the Coast and Geodetic Survey. The information gathered will provide data on the nature, location, and frequency of world earthquakes that might ultimately lead to prediction of destructive shocks.

The cornerstone of the Smithsonian's Museum of History and Technology was laid Friday, May 19. Chief Justice Earl Warren, chancellor of the Board of Regents of the Institution, and Senator Clinton P. Anderson, a regent and chairman of the Joint Congressional Committee, presided at the ceremonies. The new museum will have five floors and a basement. National collections relating to American history (civil, political, and cultural); the history of science, engineering, and manufacturing; and the history of our Armed Forces will be exhibited on three of the floors. The other floors will contain study collections, laboratories, shops for preparing exhibits, a cafeteria, and service facilities. The building will be completed in the summer of 1962.

A center for the collection and evaluation of data on atomic transition probabilities and cross sections has been established at the National Bureau of Standards. It will compile atomic data in areas where experimental or theoretical investigations are being conducted at NBS. This is part of a research program sponsored by the Office of Naval Research and the Advanced Research Projects Agency, to supply data needed for current and future research in plasma physics and astrophysics.

Chemists at the Naval Ordnance Laboratory predict that lightweight fiberglass rocket motor chambers, reinforced with non-woven glass fibers (roving), are destined soon to become standard equipment for space vehicles. These chambers may cost only a fourth as much, and be up to three times as strong on a weight basis, as the metal chambers presently in use. This prediction is based on results from a new device, "NOL Hydraulic Ring Tensile Tester," developed under the NOL program to evaluate parallel glass fiber as reinforcement for plastic pressure vessels, of which rocket motor chambers are a prime example. Test hoops are fabricated by drawing glass strands through a resin bath onto a circular mold under controlled conditions of temperature, tension, and angle of wind. Tests indicate that application of a chemical finish to glass fibers is one of the important factors in improving the tensile strength of a glass reinforced plastic. Plastics reinforced in this manner offer a means of controlling the directional strength of a structural item to a degree not possible with woven or random mat fiberglass. Also, parallel glass fibers theoretically can be packed to occupy over 90 percent of the volume in a reinforced plastic. This is important, since the strength properties of a reinforced plastic are directly proportional to the plastic glass content.